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THE BEST TWO SWEET SORGHUMS FOR FORAGE.

BY

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., March 14, 1911.

SIR: I have the honor to transmit herewith and to recommend for publication as a Farmers' Bulletin a paper entitled "The Best Two Sweet Sorghums for Forage," prepared by Mr. A. B. Conner, Scientific Assistant in the Office of Forage-Crop Investigations of this Bureau, under the direction of the Agrostologist in Charge.

At this time the several different sorghum varieties are grown promiscuously over the entire region adapted to this crop. This bulletin is prepared with a view to helping the farmer find the variety best suited to his region and to grow and improve this variety so as to obtain better yields of forage. The publication of such information should result in great benefit to the farmers throughout the sorghum region.

Respectfully,

WM. A. TAYLOR,
Acting Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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THE BEST TWO SWEET SORGHUMS FOR FORAGE.

INTRODUCTION.

Since sweet sorghum is not a money crop, its value and real worth to the farm are seldom recognized. It is a well-established fact that our greatest returns from the farm come in the way of products that are fed to animals and thus indirectly sold. In any feeding operation roughage is a necessity, and to feed most successfully from an economic standpoint one must secure the best forage to be had and at the same time one that is cheaply produced. As a roughage that is cheap and yet wholesome sorghum hay when properly cured has no equal, at least in the region where it is grown.

Aside from feeding in conjunction with concentrates, sorghum is extensively used as a supplementary feed for range stock. By its use the farmer or stockman is not infrequently enabled to carry one-third more animals per acre. All this, along with the fact that the sorghums can be grown successfully in many different types of soils under varying conditions with less difficulty than most other crops, makes it of vital importance that their growth be extended into every possible section.

Every grower should obtain a knowledge of the leading varieties, those best adapted to his region, how to grow the best yields of forage, and when and how to make his selections for the improvement of the variety. In this manner not only can a cheap forage be more widely grown, but the cost of producing it can be lessened. A more extended growth of sorghum would also supply the demand for hay to feed along with corn in the Southern and Southwestern States. This demand is very urgent. It is therefore the purpose of this publication to point out the best varieties, their area of growth, the means of getting better yields, and the best and quickest method of improving the strains for their forage value.

CLASSIFICATION AND VARIETIES OF SORGHUM.

The sorghums are divided into two general classes: (1) Those that are grown primarily for forage and sirup and (2) those that are grown for grain. The varieties of the first group are also known as

the saccharine or sweet sorghums, because of the high percentage of sugar contained in the stems. They are readily distinguished by their high saccharine content, the usually light seed head, and the large amount of tannin contained in the seed. This tannin is noticeable even after the seeds are ripe. The grain-producing varieties are sometimes known as the nonsaccharine sorghums and usually have a pithy or semipithy stem which contains little saccharine matter. They are generally recognized by their larger seed heads and their large seeds, which usually contain very little or no tannin.

Of the saccharine sorghums, the size, shape, and color of the seed head, as well as the size, shape, and color of the hulls and seeds, determine the type and variety to which they belong. There are seven important varieties, or varietal groups, of these sorghums, namely, Sumac, Amber, Orange, Planter, Gooseneck, Honey, and Sapling. The first five of these are of commercial importance. These varieties are described in this bulletin in the order of their value.

The descriptions and the comparative figures presented in Table I are from data secured in northwestern Texas and are therefore applicable directly to that region. Although the yield, time required for maturing, leafiness, etc., vary with the section in which they are grown, nevertheless these data will help the grower to form an estimate of the comparative values of the most common forage varieties and to judge what can be ordinarily expected of each. In enabling the farmer to secure the variety best suited to his region and conditions these data are important.

TABLE I.—*Growing period, yield, leafiness, and other qualities of the best eight forage sorghums.*

Variety.	Growing period.	Yield.	Number of leaves.	Sweetness. ¹	Juiciness. ¹	Tenderness. ¹	Objections.
	<i>Days.</i>	<i>Tons.</i>		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	
Red Amber....	92	4½	10 to 11	85	90	100	Suckers
Minnesota Amber.	94	4	9 to 10	86	70	80	Do.
Orange.....	98 to 108	6	11 to 12	80	80	90	Subject to blight.
Planter.....	102 to 112	6½	11 to 12	33	60	85	Lodges.
Sumac.....	108 to 114	7½	14 to 16	90	95	80	Late.
Gooseneck.....	114 to 120	7½	14 to 16	100	100	75	Coarse, late.
Honey.....	112 to 118	7½	14 to 16	100	100	80	Late.
Sapling.....	108 to 114	5½	11 to 13	80	80	80	Lodges.

¹ Estimated.

SUMAC.

Sumac sorghum is the sweetest, the leafiest, and the heaviest yielder of the strictly forage varieties. It is one of the latest maturing sorghums, producing seed in from 108 to 114 days. The plant is rather stocky, bearing 14 to 16 leaves and a small, compact, dark-red seed head. This seed head is made up of small, round, dark-red seeds about the size of duck shot. The seeds are only partially inclosed by

short, dark-colored, round glumes. This variety, unlike the others, is not readily cross-pollinated by other varieties.

AMBER.

Amber sorghums are easily recognized by the slender stems, few leaves, and open, longer branching seed heads. The stems are tender, juicy, and sweet. This is the earliest maturing variety, producing seed in from 90 to 94 days. The seeds are larger than those of Sumac, yellowish brown in color, and rather elliptical in shape, and are nearly inclosed by large, pointed hulls, which are either black or red, depending on the strain. The Amber is the lightest yielder of all, but on account of its earliness it is especially adapted to the northern region. The best two strains of Amber are the Red, which has a reddish-colored seed head, and the Minnesota, which has a dark-colored seed head.

ORANGE.

The stalk of Orange sorghum is rather large and stocky. It is less leafy than Sumac and the stem contains less juice and sugar. This stalk bears a rather compact seed head, 7 to 8 inches long. Because of the color of the hulls, which are pointed and inclose about two-thirds of the seed, the heads have a dark-brown appearance. The seeds are about the size of and somewhat less elliptical than those of Amber and somewhat larger than Sumac seed. Orange is slightly earlier than Sumac, but does not yield as heavily. If left until overripe it will be more readily attacked by spot blight than any other sorghum. It is adapted to about the same area as Sumac, though it has no advantage over it except in earliness.

PLANTER.

Planter sorghum is readily distinguished from the Orange, which it most resembles, by having a light, straw-brown seed head, which may be either open and drooping or compact. The light, straw-colored seeds are plump and half or more are inclosed by light-brown, very pointed hulls. Its stems are about as stocky and as leafy as Orange, but lack in juice and sugar content. Planter is somewhat later than Orange and is perhaps a heavier forage yielder, but lodges badly if attacked by chinch bugs. It is not considered a very desirable variety.

GOOSENECK.

Gooseneck is a tall, coarse-growing variety (12 to 14 feet high), the stems of which are exceedingly juicy and very sweet. It is quite leafy and produces heads that are either goosenecked or more

or less inclined. The head is black and nearly as wide as it is long. The seeds are yellowish brown in color and somewhat smaller than Orange seeds, and are entirely inclosed by black, shiny hulls which are more or less compressed at the tip. This variety is later in maturing than Orange, or even Sumac, and therefore can not be grown as far north. It is primarily a sirup sorghum, but has some value for forage purposes.

HONEY.

Honey sorghum is a medium-tall but not an unusually coarse-growing type. Its stems are very leafy, juicy, and sweet. The seed head is always erect, reddish in color, and of a rather open, broom-corn type. The seeds are elliptical in shape and are almost entirely inclosed by reddish, shiny hulls. It is one of the best sirup-producing sorghums, and on account of its tendency to slenderness and its leafiness it promises to be a valuable forage sort for the Southern States.

SAPLING.

Sapling is also a tall-growing variety, but is more slender than Gooseneck. Its joints are longer and it is consequently not so leafy as Gooseneck. The plant bears a long, erect head, cylindrical in shape, and resembling in general appearance the head of Red Kafir. The seeds are brownish red and about one-half inclosed by short, black hulls. The stem of this variety is not as sweet and juicy as that of Sumac. Although of some value for sirup, it is not considered a desirable forage type.

THE BEST TWO SWEET SORGHUMS AND THEIR GROWING AREA.

The best sorghum variety for any region must not only be a good yielder of forage, but must give a forage of good quality. Unlike many other crops, therefore, the heaviest yielder is not always the best variety. Furthermore, the cost of producing and harvesting the crop must be taken into account. Considering these things, the Sumac and the Amber are the best two types for the sorghum region, the former for the southern and the latter for the northern section (figs. 1 and 2). The Sumac is best for the southern region for the reason that it excels both in quality and in yield any other standard forage variety and produces this forage at a relatively smaller cost. The Amber, being early, is the only variety that is sure to mature in the northern section; hence it is the best variety for that region.

In the southern region all types mature. The early-maturing sorts give the greatest number of cuttings, but the yield per cutting is relatively small, so that the total forage for a season is perhaps less than that from the late-maturing varieties, which give fewer cuttings but

heavier yields per cutting. Furthermore, the total cost of harvesting the early types, on account of the increased number of cuttings, is greater, which makes them less profitable and less desirable in this region. This is the case with Amber sorghum, yet a considerable acreage of this variety is grown in the Southern States. The Goose-neck, Honey, and Sapling varieties are rarely grown for forage on account of the coarseness of the fodder, but they are excellent sirup varieties. The Planter is grown more or less extensively in certain limited sections in the semiarid region, but its undesirable habit of lodging, together with its small yield of juice, makes it inferior to the Sumac. The Orange is an excellent forage variety, but it matures under about the same conditions and in about the same time as Sumac



FIG. 1.—Field of Sumac sorghum grown in wide rows for forage and seed. Note the compact seed head and great number of leaves.

and its forage yield is smaller. For these reasons it is pretty generally conceded to be less profitable. The Sumac, therefore, is undoubtedly the best forage type for the southern region and its cultivation should replace that of all others.

The accompanying map (fig. 3) shows the region where Sumac sorghum should be grown.

Sumac has long been grown in portions of the Southern States, particularly in central and northwestern Texas, in parts of Oklahoma, Arkansas, Tennessee, and southward. Figure 4 shows the luxuriant growth of this variety.

It is recognized by many farmers in this region as the best forage sorghum. Nevertheless, considerable Amber is grown in the belief that it produces heavier total yields by giving a greater number of cuttings, which incidentally reduces the risk of losing hay by rains.

It is definitely known that Sumac matures easily as far north as Kansas and the northern boundary of Tennessee. Tests thus far indicate that it will produce good forage as far north as central Kansas, central Missouri, and the Ohio River. Since the remaining varieties range so close to it in time of maturity that they are of little value north of the probable Sumac area, this variety is recommended for the entire region shown on the map in figure 3.

In the northern region only an early variety will mature good seed. The Amber therefore occupies this entire section by virtue of its earliness. Although it is now grown over a considerable portion of this region, it is by no means as widely grown as it should be. By selecting early strains it can be extended even farther north than it is at present grown. The accompanying map (fig. 5) shows the region where Amber sorghum should be grown.



FIG. 2.—Field of Red Amber sorghum grown in wide rows. Compare the open seed head and few leaves of this variety with the compact head and leafiness of Sumac.

The Minnesota Amber variety is now widely grown throughout the region shown by this map (fig. 5). It is an excellent strain. The Red Amber is little known in this region at the present time.

Figures 6 and 7, respectively, show fields of Sumac and Red Amber sorghum grown thickly for hay.

Tests of the Red and the Minnesota varieties have indicated that under the same conditions the Red Amber is somewhat earlier, and it is undoubtedly more tender and perhaps sweeter and juicier than the Minnesota Amber. Early strains of the Red Amber are therefore recommended over the Minnesota variety. Either of these sorghums will produce good forage even farther north than it will mature seed, and therefore the northern limit can be determined with little risk on the part of the farmer.

FACTORS LIMITING THE GROWTH OF SORGHUM.

Although the sorghum area has spread widely in the past few years, its growth has not progressed as it should, because of several factors, the most important of which are the scarcity of seed, inferior grades of seed, bad effect on land, and failure to harvest and cure the hay properly.

SCARCITY OF SEED.

The supply of sorghum seed in recent years has been very limited, largely due to the destruction of the seed crop in the more humid sections by the sorghum midge and to the failure to get seed crops in the drier regions. The damage done by the sorghum midge is often

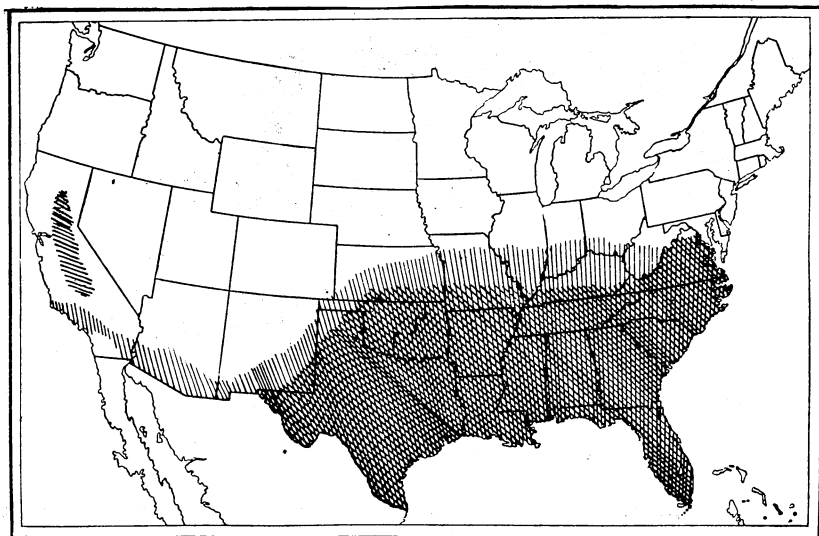


FIG. 3.—Map of the United States, the more densely shaded portion showing the region where Sumac sorghum is known to be the best forage variety, and the lighter shaded portion showing where it will probably prove to be the best variety.

so great that infested regions produce absolutely no seed. The midge region includes the more humid portions of all the Southern States, reducing the dependable seed-producing area about one-half. The work of this midge, which results in the failure of the crop to set seeds, is the so-called "blast" known in recent years throughout the infested section. This midge (*Diplosis sorghicola*) is so small that ordinarily it escapes notice when depositing its egg on the ovary at flowering time. The egg produces a larva which feeds on the juices of the ovary, preventing the formation of seed. Since moist, damp weather is most favorable to this midge, it will probably not become a serious pest in the drier regions, upon which, therefore, dependence for the supply of seed must rest. Throughout the semiarid portions

of western Oklahoma, western and northwestern Texas, eastern New Mexico, and western Kansas good seed crops are produced, and the business of growing pure and improved sorghum seed in these sections should be very profitable, since there will probably always be a good demand. The sorghum seed-producing area is further reduced by failures to get seed crops in the drier regions, either because of drought or too thick planting. In considering the quantity of sorghum planted broadcast and thickly in rows for hay it is readily seen that this feature alone will greatly affect seed production.

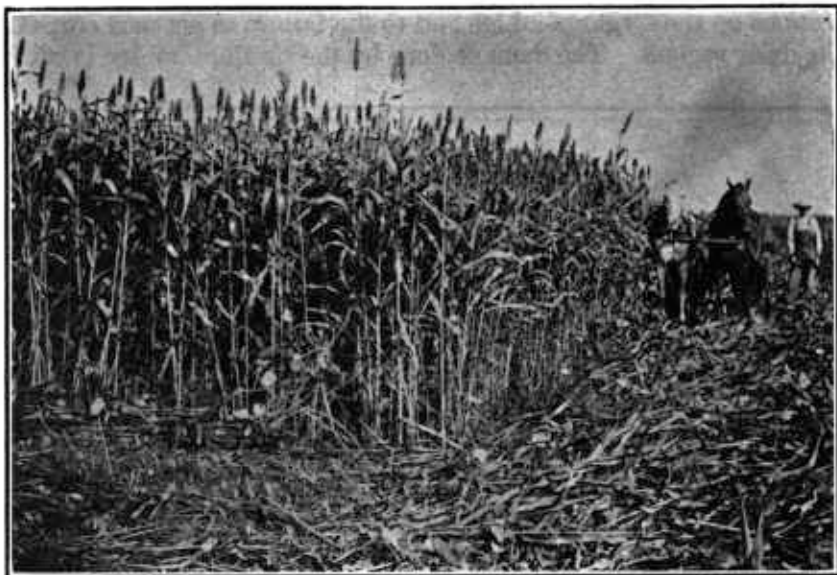


FIG. 4.—An excellent field of Sumac sorghum, showing the enormous growth made in close drills.

INFERIOR GRADES OF SEED.

A considerable portion of the seed now on the market is more or less mixed with other varieties, partly because of failure to rogue out fields grown for seed and partly because of carelessness in thrashing. Especially is this true after seasons of light seed crops and in the newer regions into which the growth of sorghum is being extended. This seed is put on the market, and is generally sold to the farmer and planted by him as if it were good seed. Such seed will not give a crop that can be harvested at the proper stage, and the hay will therefore be of very inferior quality. Furthermore, the farmer will not as a rule save seed for his own use from such a field; and if it is his first attempt at growing sorghum his idea of its yield and feeding value will be very greatly lowered. Such unsatisfactory

crops can not but tend to discourage the growth of sorghum in regions where there is any doubt of its being a profitable crop.

EFFECT OF THE CROP ON THE LAND.

The sorghums are generally supposed to have a very exhaustive effect upon the land, and in certain sections so great is this prejudice that they are but little grown. This idea is largely erroneous, for as a matter of fact sorghum is no more exhaustive than any other crop which produces an equal tonnage. The ill effects are due largely to the bad physical condition in which the sorghum leaves the land. By plowing the stubble early or running out the rows with a turning plow and later harrowing, the land will be left in excellent con-

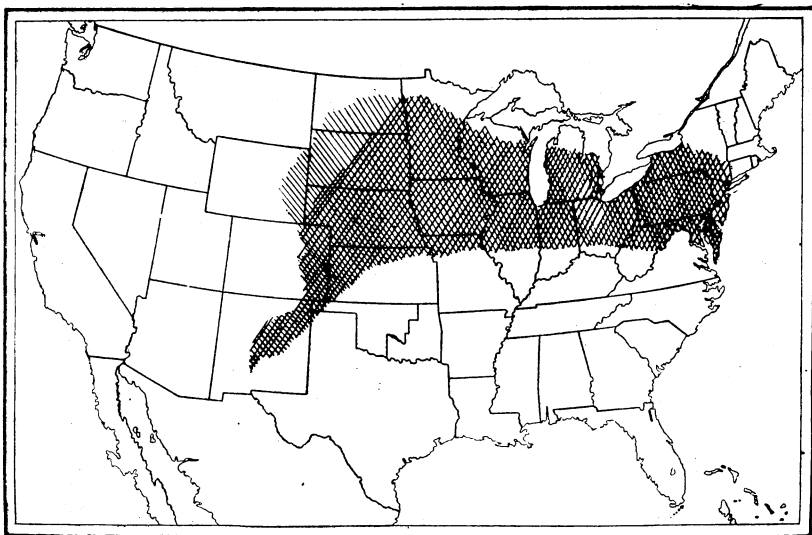


FIG. 5.—Map of the United States, the more densely shaded portion showing the region where Amber sorghum is known to be the best variety, and the lighter shaded portion showing where it is most likely to become a profitable crop.

dition for the succeeding crop. In certain parts of the semiarid region successive crops of sorghum have been grown on the same land for periods of several years without a noticeable decrease in fertility. It is safe to say that with reasonable rotation of crops and early plowing sorghum can be grown with as little ill effect on the land as any other crop except legumes.

FAILURE TO HARVEST AND CURE SORGHUM PROPERLY.

Much sorghum hay is improperly harvested by letting it stand until overripe, losing a great portion of its feeding value. Frequently the hay is cut and improperly cured, with the result that it

is less palatable and oftentimes low in feeding value. In such cases, even though the fault is with the grower, the tendency is to regard this crop as producing a poor grade of hay. This underestimate of its value is not favorable to extending its growth in newer sections.

GROWING THE BEST FORAGE YIELDS OF SORGHUM.

Although the average hay yield of sorghum is perhaps greater than that of any other annual, it can be greatly increased by observing a few vital points in the growth of this crop. While good seed and



FIG. 6.—Sumac sorghum grown thickly for hay. Note the leafiness and the fineness of the stems.



FIG. 7.—Red Amber sorghum grown thickly for hay. Note the few leaves as compared to Sumac.

good preparation of land are necessary to secure large crop yields, other equally important factors, such as time and rate of seeding and manner of planting, must not be neglected. Perhaps at this time more failures to grow heavy yields of sorghum are due to improper seeding than to any other cause, and too great care can not be given to planning and planting the crop. In many cases it would cost no more to produce a heavy yield than it does to grow a poor crop. It is therefore important to point out the principal factors to be considered in the production of heavy yields.

GOOD SEED.

The farmer can not be too careful in purchasing his seed. Good seed frequently means as much as good tillage, and careful purchases are always to be recommended as a means of increasing the quality and quantity of the crop. In procuring seed the grower (1) should take only the best variety for his locality, that is, the variety that will give the most forage of the best quality, and (2) he should see that this seed is clean and made up of whole grains that have not been cracked while being threshed. The variety should be pure and free from seeds of other varieties. If the seed obtained is trashy and a fanning mill is not available, it can be cleaned by placing it in water. All chaff and light seeds are thus removed, leaving only the clean, heavy seeds. Pure, clean, viable seed insures a uniform, regular stand and a heavier yield of good forage per acre.

THE SEED BED.

Although a large portion of the land planted to sorghum is left unplowed until a short time before planting, this practice is by no means the best. For the heaviest yields, sorghum must have a firm, well-settled seed bed. This can be had by plowing the land as early in the fall as possible and harrowing or disking to keep vegetation down until planting time. Such preparation allows whatever vegetable matter there may be on the land to decay and puts it in the best tillable condition. In the drier regions this treatment serves to take in and retain any moisture that may come during the winter season and to decrease the chance of failure by drought. In the same manner it increases the yield given in case of more favorable seasons. In the more humid region early preparation is preferable, though not so necessary as in the drier regions. The land is sometimes prepared by "bedding" or listing with a middle-buster or a turning plow.

PLANTING.

The planting of sorghum deserves more careful attention than any other operation entering into the production of the crop. The time, method, and rate of planting mean success or failure in the degree in which judgment is shown in putting in the crop. It is of vital importance, therefore, that the farmer carefully plan his seeding operations.

Time.

The sorghums are usually planted as soon after corn as the ground is thoroughly warm. They may be planted at any time from that date to as late as will permit the crop to mature safely. In the Southern States the first of April is considered early planting. To

the northward, using the northern line of Louisiana as a base, the season gets later at the rate of about one week for every two degrees of latitude, or 150 miles. As a rule, in the drier regions the sorghums are planted preferably late in the season, as this affords the cured forage less opportunity to dry out too much before feeding time. In sections where the seasons are sufficiently long to give profitable second crops from the stubble, early plantings are always preferred. This is the case throughout the more humid regions of the Southern States. Extremely late plantings are advisable only in cases where it is necessary to plant as a catch crop or as a second crop.

Method.

The sorghums are probably most often planted in close drill rows or broadcast. When such is the case the seeding is done with an ordinary wheat drill or the seed is broadcasted by hand or with a broadcast seeder. In either of the two latter cases a disk harrow or an alfalfa renovator will cover the seeds sufficiently deep to insure germination. Drilling is preferable for the reason that the seeds are more evenly distributed and are put in at a more even depth, which insures a stand with a smaller quantity of seed per acre. In broadcasting there is a tendency to plant on poorly prepared land, which results in the loss of many seeds and at best an irregular stand, although after the crop is several inches high it may appear perfectly uniform.

Throughout a great portion of the sorghum region it is the practice to plant in drill rows 3 or 3½ feet apart. Seedings made in cultivated rows give a greater tonnage than when planted in close drill rows or broadcasted, yet many prefer the latter method because of the fineness of the hay grown. Row plantings may be made in a lister furrow, on the surface, or on a bed. Furrow planting is most common in the drier region, but it is practiced to some extent in portions of the humid section. Surface seeding in the semiarid sections is less common, but as a rule it gives greater yields than deep listing, for the reason that in the latter case the stand is many times injured and even destroyed by heavy rains before or soon after germination. Surface seeding is recommended for the humid and a good portion of the semiarid regions. In any event, seedings in the latter region should not be made in deep furrows. In some of the lower and poorly drained lands plantings are made on the bed, but only under such conditions should this method be practiced.

Rate.

The rate and regularity of seeding largely influence the yield of forage, regardless of the method used. If planted with a wheat drill 1 bushel per acre is found to give the heaviest yields and the best quality of hay throughout the semiarid region. In extremely dry

sections one-half bushel will be sufficient. In the more humid regions 2 bushels per acre prove more satisfactory, and if the seeds are evenly distributed more than this quantity is not necessary except, perhaps, where irrigation is practiced.

In drill rows 3 or 3½ feet apart about 15 to 20 pounds per acre will give a stand sufficiently thick to give hay of a most excellent quality. Thick plantings make a uniform growth and produce crops that are uniform in maturing. Such conditions are conducive to harvesting the greater part of the crop at the proper stage, thereby securing hay of the best quality. Thinner plantings are not recommended except in very dry sections, as they do not give the best quality or yields of hay, nor are they as easily handled. In doubling the number of plants on a given piece of land one doubles the number of leaves and thereby increases the quality of his hay by increasing the digestible portion and decreasing the percentage of fiber. As much as 25 or 30 pounds per acre would not be too thick for the more humid sections. The thickest seeding that can be grown without decreasing the yield undoubtedly approaches nearest the ideal crop.

CULTIVATING.

While sorghum will grow and give good yields with little or no cultivation, this is by no means the most profitable or the most economical method of producing a crop. Judicious cultivation has repeatedly been known to increase materially the yield of forage per acre. In rows it is generally conceded that cultivation is necessary, but such a crop seldom gets the proper cultivation at the right time. The first cultivation can be given with a spike-tooth harrow. As soon as possible after harrowing it should be cultivated deeply, and later in the season it should be given two additional shallower cultivations. This will insure a good crop. When broadcasted or planted in close drill rows at least one harrowing and two later cultivations with a weeder are necessary for the heaviest crops of hay. This can be done the last time when the crop is 2 or 2½ feet high and will put the surface soil in perfect condition to retain all moisture for the use of the growing sorghum.

SORGHUM-COWPEA MIXTURES.

Not much work has been done with sorghum-cowpea mixtures as a crop, but wherever grown they have shown considerable promise. Some work of this kind at Brownsville, San Antonio, Chillicothe, and Amarillo, Tex., has presented certain features concerning the growth of mixtures which may well be called to the attention of sorghum growers. These points deal with the varieties and proportions of each used in mixtures, the quantity to plant per acre, and the manner of planting.

Sorghum-cowpea mixtures, if proportioned and planted properly, perhaps do not give as great forage yields as sorghum alone, but the quality of the hay is superior, since the legume supplies protein, making the forage almost a complete ration. This hay, if cured properly, is relished by all live stock. No doubt the bad effect the sorghums have on land will be materially lessened by growing this crop in mixtures with legumes.

Probably the most commonly grown mixture is Amber sorghum and Whippoorwill cowpeas, although results obtained thus far at the places mentioned above indicate that Sumac sorghum and some vigorous cowpea, such as the Brabham or Unknown, will give the best crops of forage, especially in the more humid sections. It appears also that the Sumac, or some variety that does not make too quick growth, is preferable in the drier sections.

Mixtures of six parts by measure of Whippoorwill cowpeas to one of Amber sorghum have given the desired proportionate stands of cowpeas and sorghum. The basis of any mixture should depend on the proportionate sizes of the seeds to be mixed, and since the Sumac seed is smaller than that of Amber, a mixture using this variety will require a somewhat greater proportion of cowpeas.

In growing mixtures the rate of seeding has as much to do with the quantity and quality of the crop as when sorghum alone is grown. Results have shown that without irrigation from 1 to 1½ bushels of the mixture per acre, when broadcasted, will give an excellent crop, while for irrigated lands 3 bushels per acre is not considered too much. When seeded in rows, from 8 to 30 pounds is recommended, depending on the dryness of the region. The seed of the mixture should be evenly distributed, and this can best be done by drilling the seeds of the two crops separately or by thoroughly mixing the seeds before putting them into the drill. Any agitation after the seed has been put in the drill will cause the smaller seed to sink to the bottom.

Undoubtedly the most satisfactory way to grow these mixtures, especially where the moisture supply is abundant, is in close drills or broadcast. This seems to produce a more erect growth of the legume, and consequently the harvesting is much more satisfactory. In wide-spaced rows there is a tendency for the sorghum to grow too coarse and for the legume to spread too much, and only where the supply of moisture is limited is planting in this manner recommended.

Broadcasted or close-drilled mixtures can be harvested quite satisfactorily with the mower and no doubt to advantage with a wheat binder. If grown in rows and harvested with a mower the hay is difficult to handle on account of its coarseness. The least difficulty is experienced in harvesting when the plants are evenly distributed in the row.

WHEN AND HOW TO HARVEST SORGHUM.

The sorghums should be harvested when in the late milk stage. If cut at this time, the forage is more palatable and will give the greatest feeding value per acre. Large fields can be cut in the same order in which they were planted, which will in most cases allow harvesting at the proper time. Crops that mature evenly can be harvested much more satisfactorily than fields that mature irregularly. Where a seed crop is desired, cutting can be delayed until the seed is well in the dough stage without materially decreasing the feeding value of the forage. Cutting should not, however, be delayed so long except for the sake of a seed crop. In case the field to be harvested does not reach maturity, which is sometimes the case in dry regions, it is best to allow as much growth as possible before cutting. In the more humid regions the time of harvesting should depend somewhat upon the weather conditions, early cutting being preferable when weather conditions are favorable.

If planted in rows, the sorghums are usually cut with a corn harvester and put in shocks of 12 to 60 bundles each. When planted broadcast or in close drill rows, the ordinary wheat binder can be operated quite successfully. These bundles can likewise be put in shocks, as from a corn harvester, and left to cure. Frequently broadcast or close-drilled seedings are cut with a mower.

CURING SORGHUM HAY.

Probably more than half the sorghum grown for hay is improperly cured. Inasmuch as curing greatly affects the quality and palatability of the hay and the ease with which it can be marketed, it is a very important factor to be considered.

Most frequently in curing too much sunlight is given, which darkens and injures the hay, allowing much of its flavor and aroma to escape, and aside from making hay less palatable also burns and destroys much of its feeding value. Mown sorghum should therefore never be left in the swath to cure, but should be raked into windrows and cocks as soon as thoroughly wilted, which is usually about one day after cutting. These cocks, as left by the rake, should be forked around the edges and left untouched to settle and cure. The curing usually takes about three or four weeks of sunshiny weather, and by that time it will have cured into bright, sweet, well-flavored hay. In humid regions these cocks should be made quite small, so that in case of rainfall they will dry out without molding. In some regions where the rainfall is abundant it is customary to leave the hay in the swath so as to hasten curing and thus avoid getting it wet, but it is doubtful whether curing is hastened sufficiently in this manner to justify the loss by burning. Even in such regions

it might in most cases be more profitable to cure in small cocks, for only in this manner can the best grade of hay be secured. In the drier regions these cocks may safely be made quite large.

In curing bundled sorghum the same principles must be observed by putting it immediately into shocks varying in size from 12 to 60 bundles, depending on the dryness of the region. Preferably, these shocks should be large and the hay will be bright, sweet, and palatable.

In the more humid regions sorghum hay should be stacked or stored immediately after it is thoroughly cured. This is not so urgent in the drier regions, because the hay is less likely to be damaged by rain; however, unless it is to be fed early from the field it should be hauled and stored as soon after curing as possible.

STORING AND FEEDING SORGHUM.

In storing it is necessary to haul the hay to the barn or to a convenient stacking place. This hauling necessitates considerable labor, as sorghum hay is always more or less difficult to handle. The use of a low-wheeled wagon truck with a broad platform or hay frame will greatly save the labor of loading, whether the hay is loose, baled, or bundled. If bundled it will have pressed together sufficiently in curing to occupy little more space than baled hay, and it can therefore be stored under shelter to advantage or in fairly good shape by stacking in the open. If it is desirable to store the hay loose it can best be stacked in the same manner. Stacks, whether made of loose or bundled hay, should be made long and narrow, and in line with the prevailing wind, so as to avoid their being blown over or decapped. Baled hay should be put under shelter or well capped with loose hay.

If properly cured, so as to retain its flavor and aroma, sorghum hay is one of the best kinds of roughage grown on the farm, and all live stock eat it greedily. The large amount of sugar contained in the stems makes it more palatable, and results from feeding it are very satisfactory. It is the cheapest and perhaps the best roughage to be had throughout the Southern States, and in sections where little or no roughage is fed through the winter months it will be found a most excellent additional feed. Horses and cattle can be kept through the winter in good condition on sorghum hay with very little additional grain. If in bundles, one bundle at a feed will be sufficient for either a horse or a cow, and if loose or baled, about 12 to 15 pounds will be required. When feeding loose hay from the stack the use of a hay knife for cutting will be found the most satisfactory way of getting out the hay, and it should always be taken from the end of the stack least exposed to the weather.

MARKETING THE CROP.

Inasmuch as loose hay can not be delivered to other than the local markets, it must be baled. This can be done at harvest time or at any convenient time later if the hay is properly stacked. When baled, all sorghum grown broadcast or in close drills, if sown sufficiently thick not to be coarse, can be disposed of advantageously, as this hay finds a ready market in carload lots at a price somewhat lower than that of prairie hay. The tonnage per acre is great, and it is therefore a very profitable crop. The fineness of the hay and the manner in which it has been cured has much to do with its finding a ready sale.

Bundled sorghum at the present time has no market other than in the locality where it is grown. While it will never enter the general market, it is feasible and proper that sorghum in this form should find sale with individuals who feed considerable quantities of hay, for the reason that it can be supplied to near-by markets much more cheaply than when baled on account of the fact that the cost of preparing it for market is not so great. If planted thickly in the row the quality is about the same.

As for shipping, bundled sorghum hay would undoubtedly take the same rate as baled hay, provided the shipper guarantees the minimum carload, which is about 16,000 pounds, or 8 tons. This weight of bundled sorghum hay can easily be placed in a car provided the weather conditions are right. It is definitely known that 10 tons of bundled kafir, averaging $14\frac{1}{2}$ pounds per bundle, can be placed in a car without difficulty in favorable weather. During the past two seasons sorghum has been a very profitable hay crop throughout the region where it is grown.

GROWING PURE AND IMPROVED SEED OF SORGHUM.

There is at present, and probably will remain for some time, a heavy demand for pure and improved sorghum seed. This demand can be supplied only by farmers and growers in the semiarid region, where the midge is not a pest. To produce the best crop and to sell to the best advantage the seed should by all means be pure, and after this the degree to which it has been bred marks its value. Therefore, in attempting to grow sorghum seed for the market, the farmer should first obtain pure seed. Obtaining such, he should set aside about an acre of land to be used as a seed patch. This seed patch should be apart from the regular field and separated as far as possible from any other variety of sorghum. Unless the grower is able to isolate each variety he should not attempt to grow more than one. This seed patch should be planted each year by the head-to-row method, and at about the time of maturity selections should be made

for seed to plant the seed patch the succeeding year. Selections should be made only from the best row, and in picking an individual the conditions under which it has produced its good characters should be considered. Leafiness, sweetness, and juiciness of stem, as well as the forage yield, are important factors. In making selections care should be taken that only plants characteristic of the variety are chosen. In case there is any impurity in the field it should be carefully rogued from the patch, and this should be done as soon as the heads have emerged and before they have scattered pollen. Seed for the general field will be produced each year by the seed patch, while market seed can be secured from the general field.

Sorghums grown for seed should always be planted in rows 3 feet apart, with plants from 4 to 6 inches apart in the drill. This will insure a heavier seed crop and strong, fully developed seeds. Plantings for seed should be made early in the season, as late plantings often produce poor seed crops. If sufficient care is taken to produce only good, strong, pure seed, no difficulty will be experienced in marketing it at a price sufficiently great to more than justify the care and extra labor.

SUMMARY.

There are seven important varieties or varietal groups of saccharine sorghum, namely, Sumac, Amber, Orange, Planter, Goose-neck, Honey, and Sapling.

The best variety for a given region is not necessarily the one that gives the heaviest forage yield, but the one that gives the greatest quantity of forage of the best quality. The sorghum region is approximately divided into two sections by the central line of Kansas and Missouri. The Sumac and the Amber are considered the best types for the southern and northern regions, respectively.

The four most important factors tending to retard the extension of the growth of sorghums are scarcity of seed, inferior grades of seed, bad effect on land, and failure to harvest and cure the hay properly.

The best yields of forage depend largely on good seed and a well-prepared seed bed, but perhaps to a greater extent on the time, method, and rate of seeding. The thickest seeding that can be grown without decreasing the yield undoubtedly approaches nearest the ideal crop.

Sorghum-cowpea mixtures may not give as great yields as sorghum alone, but the quality of the hay is superior. Sumac sorghum and some vigorous-growing cowpea, such as the Brabham or Unknown, seem to give the best crops. Six parts of cowpeas to one of sorghum will give about the desired proportionate stand in the mixtures. Without irrigation, from 1 to 1½ bushels of seed per acre when broad-

casted will give an excellent crop, while for irrigated lands 3 bushels is not too much. When seeded in rows, from 8 to 30 pounds to the acre is recommended.

For the best quality and quantity of forage, sorghum should be harvested when the seeds are in the late milk stage. If planted in rows, it can be cut with a corn harvester; if in close drills or broadcast, either a binder or a mower can be used.

The hay should be cured by putting it into shocks or cocks immediately after it has been harvested. This gives a bright, sweet, palatable feed. Sorghum hay should be stored as soon as possible after it has thoroughly cured.

A low-wheeled wagon truck with a broad platform will be found a great labor saver in hauling the crop. Well-cured sorghum hay is an excellent winter feed, and horses and cattle fed on it with a small additional grain ration can be kept in excellent condition.

Baled sorghum hay finds a ready market in carload lots at a price somewhat lower than that of prairie hay. Although bundled sorghum has no market at the present time, it might readily be disposed of to individual feeders. It takes the same shipping rate as baled hay, and the minimum tonnage can be placed in a car. If planted thickly in rows, the fineness of the stems will be materially increased and the hay is not less desirable than when baled. It can be prepared for market more cheaply than the baled hay.

Good seed crops can be secured with safety only in the less humid regions not infested with midge. The business of growing seed in this region should become very profitable. With sufficient care to produce only good, strong, pure seed, no difficulty will be experienced in marketing it at a price sufficiently great to more than justify the care and extra labor.

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